THE SPREAD OF CONTAGIOUS DISEASES

Subject: Science | **Current:** 2009 | **Grade:** 9-12 **Day:** 1 of 1

1 Purpose

To allow students to participate in a demonstration about the spread of disease and the effect of different variables on the spread of the disease.

2 Duration

50 minutes

3 Objectives

At the end of this lesson, students should be able to:

- Enhance problem-solving skills
- Increase understanding of epidemiological issues and disease transmission.
- Develop data management and interpretation skills.

4 Standards Addressed

Individuals have some responsibility for their own health. Students should engage in personal care – dental hygiene, cleanliness, and exercise--- that will maintain and improve health. Understandings include how communicable diseases, such as colds, are transmitted and some of the body's defense mechanisms that prevent or overcome illness. (NSES, p. 140)

BENCHMARKS

Level 1

Student demonstrates an understanding of the importance of personal hygiene in disease prevention.

Level 2

All of level 1 and; student demonstrates an understanding of the various levels of transmission of contagious diseases.

Level 3

All of level 1 and level 2 and: student demonstrates an understanding of the body's defense mechanisms that prevent or overcome illness.

The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease-producing organism. Many diseases can be prevented, controlled or cured. Some diseases, such as cancer, result from body dysfunctions and cannot be transmitted. (NSES, p. 197).

BENCHMARKS

Level 1

All of level 1 and; student demonstrates an understanding of the various levels of transmission of contagious diseases.

Level 2

All of level 1 and: student demonstrates an understanding of methods of prevention.

Level 3

All of 1 and 2 and: student demonstrates an understanding of the variation of control and cure.

STATE STANDARDS: MATHEMATICS

Algebra 1

Students use a variety of strategies to solve problems. Students develop and evaluate mathematical arguments and proofs. **A1.9**

Use a variety of problem solving strategies, such as drawing a diagram, making a chart, guess-and-check, solving a simpler problem, writing an equation, and working backwards. **A1.9.1**

Algebra 2

Students use a variety of strategies to solve problems. Students develop and evaluate mathematical arguments and proofs. **A2.10**

Students use a variety of strategies to solve problems. Students develop and evaluate mathematical arguments and proofs. **A2.10**

Geometry

Students use a variety of strategies to solve problems. Students develop and evaluate mathematical arguments and proofs. **G.8**

Students use a variety of strategies to solve problems. Students develop and evaluate mathematical arguments and proofs. **G.8.1**

Pre-Calculus

Students use a variety of strategies to solve problems. Students develop and evaluate mathematical arguments and proofs. **PC.9**

Students use a variety of strategies to solve problems. Students develop and evaluate mathematical arguments and proofs. **PC.9.1**

Integrated Mathematics 1

Develop the skill of algorithmic problem solving: designing, using, and analyzing systematic procedures for problem solving. **IM1.6.4**

Integrated Mathematics 2

Students use graphs and networks as mathematical models and use matrices to solve problems. **IM2.5**

Develop the skill of algorithmic problem solving: designing, using, and analyzing systematic procedures for problem solving. **IM2.5.2**

Students use a variety of strategies to solve problems and develop and evaluate mathematical arguments and proofs. **IM2.5.2**

Integrated Mathematics 3

Students use a variety of strategies to solve problems and develop and evaluate mathematical arguments and proofs. **IM3.7**

Understand that the logic of equation solving begins with the assumption that the variable is a number that satisfies the equation and that the steps taken when solving equations create new equations that have, in most cases, the same solution set as the original. Understand that similar logic applies to solving systems of equations simultaneously. **IM3.7.1**

5 Vocabulary

Students should become familiar with the following terms:

Contagion: a disease that is communicated by direct or indirect contact

Vaccination: a weakened or altered version of a microorganism that is harmless and introduced to the body in order to induce immunity

Pathogen: a disease causing agent

Epidemiology: The branch of medicine that deals with the study of the causes, distribution, and control of disease in populations.

Immunity: the condition that permits either natural or acquired resistance to disease

Contamination: The presence of extraneous, especially infectious, material that renders a substance or preparation impure or harmful.

Infection: Invasion by and multiplication of pathogenic microorganisms in a bodily part or tissue, which may produce subsequent tissue injury and progress to overt disease through a variety of cellular or toxic mechanisms.

6 Materials

Materials used in the lesson:

- Dice of three different colors. Enough for 1/student.
- 3 different color cups, enough so each student has one of each color
- Data collection sheets

7 Additional Resources

Software for spreadsheets and graphing if desired.

8 Procedures & Methods

A. Introduction

Review the life cycle of bacteria.
http://www.textbookofbacteriology.net/

Ask students why some diseases were not kept under control (plague etc.)

B. Development

Discuss the factors involved in the spread of disease.

- Length of time that it is contagious
- Infectivity
- Distance at which you can catch it
- Susceptibility of populations

C. Practice

Each student will have a die and 3 different colored cups.

White cup is a healthy and never infected person.
Red cup is someone who is sick with a infectious disease.
Blue cup is a person who has recovered and is immune to the disease.

Randomly select one student to be infected and have the student stack his/her cups so the red cup is visible on the outside of the stack. Everyone else should stack the cups so the white cup is on the outside.

Cycle 2. Any student who is next to or diagonal from the infected student should roll the die. If the students roll a 1 or 2 they contract the disease and should change their cups to show the red cup on the outside indicating infection. This disease has an infectivity of 33% because 33% of the times you will roll a 1 or 2.

Record Data: Have the students record the number of sick and healthy students in the row for cycle 2 on their sheets.

The original student is now immune and should expose the blue cup.

Cycle 3. Students adjacent to an infected person (red cup) should roll the die. If they roll a 1 or 2, they become infected and should expose the red cup in their stack. Immune students (blue) can not catch the disease and do not need to roll the die.

Record Data: Have students record the number of sick and healthy students in the row for cycle 3 on their sheets.

Those who were infected in cycle 2 are now immune and should expose their blue cup.

Continue until almost everyone has a blue cup.

Repeat the activity again and change the infectivity of the disease to demonstrate the change in timeline of spread. Students who roll a 1,2,3,or 4 will become infected (67% infectivity).

Have students collect data every cycle.

Repeat the activity with the infectivity at 67%, and change the length of contagion. Once you students get the flu you they will remain infectious for 2 cycles.

Have students graph the data and discuss the representations that are created to interpret the data.

D. Independent Practice

Students will simulate the labs individually on paper with colored "bingo" chips.

E. Accomodations (Differentiated Instruction)

Students who are ready can utilize a computer program to create their graphs.

Students who will be overwhelmed by this can graph on graphing paper.

F. Checking for Understanding

Students will write up lab report on the data collected and include graphed demonstration of the data.

G. Closure

Discuss how this could simulate a real life outbreak. In what ways is the simulation a good model and in what ways is it a weak model?

Discuss methods for preventing diseases. Ask students how this could be simulated using the model demonstrated in class.

10 Evaluation

Check the students' graphs and lab reports for accuracy.

11 Teacher Reflection

Teacher will reflect on the lesson after teaching it.

12 Resources & Media

Resources used throughout the lesson:

- Dice of three different colors. Enough for 1/student.
- 3 different color cups, enough so each student has one of each color
- Data collection sheets
- Software for spreadsheets and graphing if desired
- http://www.textbookofbacteriology.net/